Current Status of Spares for Low-Beta Devices (as of April, 2002)
TD-02-004

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Introduction
In their ten (+) years of service, low-beta devices have proven to be very reliable. And although the present spares strategy has been successful, there is a perceived fear that some low-beta devices may soon fail for various reasons, for example, long-term effects of repetitive quenches. It is this fear that, at least in part, prompted the need to conduct an investigation into the spares situation for low-beta devices.

To this end we conducted a (thorough) search of all available records and interviewed available personnel. This report is the compilation of the results of those efforts. We have chosen to defer intensive study of some issues which may need to be addressed if it is deemed desirable to fabricate more devices.

Q1/Q5 devices
The device name prefix for all completed Q1 and Q5 devices is “N54”. The "N" means that no beam position monitor (BPM) is present and the "54" is its magnetic length in inches. The Q1 and Q5 magnets perform different function in the low-beta insertions, but a way was found to make the magnets identical, and so Q1 and Q5 devices are interchangeable.

The Collider Run I configuration had eight installed and two spares. The Run II configuration has only six devices installed, which leaves four devices "above ground."

We currently have three ready-to-use spares for Q1/Q5: N5401F, N5413F and N5423F. N5401F is the only one that has never been used in the Tevatron. The fourth above ground device, N5415F, has a confirmed cold leak. We are not able to locate the cold leak, and so it is not known how much effort would be required to repair this device. However, since its quench performance and harmonics are satisfactory, this device needs to be retained in the list of potential spares. Its repair could entail placing the existing cold mass into a functioning cryostat, or re-skinning the cold mass assembly also could be necessary.

A “reserve” cold mass was fabricated for Q1/Q5 devices whose serial number is 5425. It was loaned to LHC for quench testing below 2 K at LBL. A report[1] was generated which summarized this quench testing. Magnetic field harmonics are not available.

Q2/Q4 devices
The device name prefix for all completed Q2 devices is “N13” and the prefix for all completed Q4 devices is “B13”. The "N" means that no BPM is present, the "B" means that both vertical and horizontal BPMs are present, and the "13" represents the magnetic length of 132 inches. Although Q2 and Q4 devices are not interchangeable, they use the same cold mass.

The Run I and Run II Tevatron configurations are the same. Each calls for four of each device to be installed, and we have one spare of each type. N1303F and B1315F are the present spares, and each has performed satisfactorily in the Tevatron in the past. The installed Q4 B1313F had a hi-

[1] Low Temperature Quench Performance of Fermilab Low-β Insertion Quadrupoles, FERMILAB-Conf-97/066-E

pot problem reported by Beams Division (BD) in 1997, which was later confirmed in the IB1 test facility in 1998. In consultation with BD, it was decided not to do disassembly work to investigate the hi-pot problem because we would then have no ready spare for an unpredictable amount of time. The device was cold tested successfully in the IB1 test facility in 2000, and it is currently being used in the Tevatron.

Regarding repairs, N1305F and B1311F required minor repairs after the CDF torroid incident in 1998. N1309F has a twisted lead flag, which does not negatively effect operations or performance. There are no known magnetic or quench performance problems associated with any Q2/Q4 device.

A single “reserve” cold mass was fabricated for Q2/Q4 devices whose serial number is 1319. This cold mass has never been warm or cold tested, which means that no performance data are available for it. However, all completed Q2/Q4 magnets had satisfactory quench and magnetic performance, and so we expect the same to be true for 1319.

Q3 devices

The device name prefix for all completed Q3 devices is “N23”. The "N" means that no BPM is present, and the "23" represents the magnetic length of 232 inches. The Run I and Run II configurations are the same. Each calls for four devices to be installed, and we have one spare. N2303F is the present spare, and it performed satisfactorily in the Tevatron in the past.

Regarding repairs, the quench propagation heaters failed in N2301F in 1998 and were successfully repaired. N2303F required minor repairs after the CDF torroid incident in 1998. There are no known performance problems associated with any Q3 device.

A “reserve” cold mass was fabricated for Q3 devices whose serial number is 2311. This cold mass has never been warm or cold tested, which means that no performance data are available for it. However, all completed Q3 magnets had satisfactory quench and magnetic performance, and so we expect the same to be true for 2311.

J/K spools

J/K spools have a 72" slot length, and both have a strong upstream corrector known as both T6 and Q6 (the serial number for the spare correctors use T6). The T6/Q6 cross-section design is called in local jargon "the 717 design", which is also the design of the Q1/Q5, Q2/Q4 and Q3 magnets. So the low-beta insertions contain four different lengths of the 717 design quadrupoles.

The only difference between J and K spools is in their downstream weak correctors: J spools have a DSQ I, and K spools have a DSQ II (the steering dipole operates in the horizontal plane in DSQ I and in the vertical plane in DSQ II).

The present configuration of the Tevatron calls for two of each type to be installed, and we have one spare of each type. The present spares are TSJ002, and TSK003. TSJ002 suffered extensive damage when a Kautzky valve failed to open. This spool has been restored to working order. The sextupole winding in the weak nested corrector in TSK003 is electrically open. However, in the present usage the sextupole in TSK spools is not powered, and so BD deems this to be an adequate spare. Replacing this weak nested corrector is very time consuming and labor intensive work. Refer to the section below (Repair of low-beta devices) for details. For the duration of the repair process there would be no spare to support operations. Beams Division has communicated to Technical Division (TD) that if there were a shutdown of sufficient duration TD should use that time to replace the weak corrector. TD has identified a corrector in inventory that could be used.

To date, two T6 strong quadrupole correctors (MB-217812) have been located: serial numbers T6-002 and T6-009. T6-009 appears to be the “reserve” cold mass, and the quench performance plot (attachment I) shows that this corrector has excellent quench properties. T6-002 was originally installed in TSK002. This spool was scrapped, and its weak corrector was then used in TSK004. It is unknown why the strong corrector was not reused. A recent inspection showed that T6-002 is electrically sound. This, in conjunction with the good quench performance (attachment II), has lead us to classify T6-002 as a second good “reserve” cold mass. See below for the status of spare weak, nested correctors.

L/P spools

L/P spools have a 56.149" slot length and only one corrector. L spools have a 30" DD weak, and P spools have a DDQ weak corrector.

The Run I configuration called for four of each to be installed, leaving us with one spare of each type. Run II configuration calls for four Ls and two Ps to be installed. This leaves ones spare L and three spare P spools. The present ready-to-use spares are TSL006, TSP001, TSP004 and TSP005. See below for the status of spare weak, nested correctors.

M/N spools

M/N spools have a 72" slot length, and both use a "5 in 1" (a.k.a. S5) upstream strong quadrupole corrector.

The only difference between M & N spools is in their downstream weak corrector: M spools use a DSQ I, and N spools use a DSQ II (the steering dipole operates in the horizontal plane in DSQ I and in the vertical plane in DSQ II).

The present configuration of the Tevatron calls for six of each type to be installed, and we have two of each type above ground. The present ready-to-use spares are TSM008, TSN007, and TSN008. TSM005 has a 1-phase leak, which is a hard repair.

There appear to be no “reserve” S5 cold mass. Laboratory 2 (where S5 correctors were tested prior to incorporation into spool frames) log books record that one prototype was built, and then 16 production magnets. There are 16 M/N spools in use, which means that no "reserve" cold mass is available. See below for the status of spare weak, nested correctors. Attachment III is a graph of ramp-to-quench rates for S5 cold masses.

Summary of Completed Devices

The following table summarizes the current status of all completed low-beta devices:

Type	Serial Number	Status	Comments
Q1/Q5	N5401F	Ready to use	
Q1/Q5	N5403F	Installed	
Q1/Q5	N5405F	Scrapped	

Q1/Q5	N5407F	Scrapped	
Q1/Q5	N5409F	Installed	
Q1/Q5	N5411F	Installed	
Q1/Q5	N5413F	Ready to use	
Q1/Q5	N5415F	Needs repair	Cold leak
Q1/Q5	N5417F	Installed	
Q1/Q5	N5419F	Installed	
Q1/Q5	N5421F	Installed	
Q1/Q5	N5423F	Ready to use	
Q2	N1301F	Installed	
Q2	N1303F	Ready to use	
Q2	N1305F	Installed	
Q2	N1307F	Installed	
Q2	N1309F	Installed	
Q3	N2301F	Installed	
Q3	N2303F	Ready to use	
Q3	N2305F	Installed	
Q3	N2307F	Installed	
Q3	N2309F	Installed	
Q4	B1311F	Installed	
Q4	B1313F	Installed	Hi-pot problem
Q4	B1315F	Ready to use	
Q4	B1317F	Installed	
Q4	B1321F	Installed	
J spool	TSJ001	Installed	
J spool	TSJ002	Ready to use	
J spool	TSJ003	Installed	
K spool	TSK001	Installed	
K spool	TSK002	Scrapped	
K spool	TSK003	Ready to use	Octupole open
K spool	TSK004	Installed	
L spool	TSL001	Installed	
L spool	TSL002	Installed	
L spool	TSL003	Installed	
L spool	TSL004	Installed	
L spool	TSL005	Scrapped	
L spool	TSL006	Ready to use	
P spool	TSP001	Ready to use	
P spool	TSP002	Installed	
P spool	TSP003	Installed	
P spool	TSP004	Ready to use	
P spool	TSP005	Ready to use	
M spool	TSM001	Installed	
M spool	TSM002	Installed	
M spool	TSM003	Installed	
M spool	TSM004	Installed	
M spool	TSM005	Hard repair	1-phase leak
M spool	TSM006	Installed	
M spool	TSM007	Installed	
M spool	TSM008	Ready to use	

N spool	TSN001	Installed	
N spool	TSN002	Installed	
N spool	TSN003	Installed	
N spool	TSN004	Installed	
N spool	TSN005	Installed	
N spool	TSN006	Installed	
N spool	TSN007	Ready to use	
N spool	TSN008	Ready to use	

Weak, nested correctors

The following table summarizes what we presently know for each "unused" weak corrector (There are some potentially usable correctors that could be salvaged from unrepairable spools; they are listed further below):

Type:	DSQI	DSQII	OSQII	OSQIII	DDQ
Drawing:	MD-124821	124822	125331	125332	125722
Count:	5	3	2	1	1

DSQI-023	The "Correction Magnet Production Record" log records that DSQI-023 is a "DUD - Sextupole short to cooling tube - 6/17/1981". A 15-Feb-02 measurement in IB1 indicates that this is a good corrector. A Mar-02 inspection in IB2 showed that this device is electrically sound. This corrector was used to check quadrupole windings of harmonics probes, and so it is still mounted on a tube that prevents it from being installed in a spool. It is not known whether or not this tube can be removed.
DSQI-170	Log records indicate it successfully passed electrical inspection ~ 10/1985. An 18-Feb-02 measurement in IB1 indicates that the sextupole and quad centers differ by more than 1 mm, otherwise this is a good corrector.
DSQI-172	Log records indicate it successfully passed electrical inspection ~ 4/1986. A 13-Feb-02 measurement in IB1 indicates that the sextupole angle is off by 13 mrad, otherwise this is a good corrector.
DSQI-174	Log records indicate it successfully passed electrical inspection ~ 4/1986. A 14-Feb-02 measurement in IB1 indicates that the dipole angle is off by 16 mrad, otherwise this is a good corrector.
DSQI-198	An 18-Feb-02 measurement in IB1 indicates that this is a good corrector.
DSQII-092	Log records indicate it successfully passed electrical inspection on 11/18/1981. A 15-Feb-02 measurement in IB1 indicates that this is a good corrector.
DSQII-153	Measured in IB1 in February 2001; now judged to be good.
DSQII-177	Measured in IB1 in February 2001; now judged to be good. However, a measurement from IB2 shows that the sextupole inductance is out of specification: 433 mH, where specification is 404-425 mH.
OSQII-074	Log records indicate it successfully passed electrical inspection ~ 9/1985. A 20-Feb-02 measurement in IB1 indicates that the sextupole angle is off by 17 mrad, otherwise this is a good corrector.
OSQII-076	Log records it successfully passed electrical inspection ~ 5/1986. A 19-Feb-02 measurement in IB1 indicates that this is a good corrector.
OSQIII-020	Log records indicate it successfully passed electrical inspection ~ 2/1986. A 20-Feb-02 measurement in IB1 indicates that this is a good corrector.
DDQ-035	A 12-Mar-02 measurement in IB1 indicates that this is a good corrector.

Another potential source of correctors is salvaging them from other spools. Here is the present list of salvageable spools containing DSQ, OSQ, DDQ or DD correctors, and what we know about them (note: TSD393 & TSD395 are "new" spools, and fabrication has been suspended):

TSC098	DSQI-68	Unknown.
	OSQI-71	Unknown.
TSH377	DDQ-31	Spool cut up for HTS program. Corrector status is unknown.
TSE043	DSQI-37	Tag on spool reads "elements 1&2 and 5&6 are open", which likely means that this corrector is no good.
	OSQII-5	Unknown.
TSF380	DSQII-156	Unknown.
	OSQII-75	Unknown.
TSD393	DSQII-173	IB1 measurement from October 2001 shows that one pole is wired backwards.
	OSQI-119	IB1 measurement from October 2001 shows that it is good.
TSD395	DSQII-124	IB1 measurement from October 2001 shows that it is good.
	OSQI-069	IB1 measurement from October 2001 shows that it is good.
TSIA346	DD 30" #3	Unknown.
TSI347	DD 30" #5	Unknown.
TSI348	DD 30" #2	Unknown.
TSIA362	DD 30" #6	Unknown.

(The IB1 test facility has recently developed a stretched wire apparatus that can be used to assess magnetic performance of nested, weak correctors.)

Production inspection data show that room temperature resistance measurements are different between the nested coils in H and P spool correctors (i.e. DDQ corrector) and I and L spool correctors (i.e. DD corrector). These data indicated that the following issues had to be addressed:

- Are the weak correctors in the six low-beta spool series new designs, or are they old designs that appear in standard spools?
- If any are old designs, did we wind new correctors to this design, use previously made correctors, or a mixture of the two?
- If we wound new correctors, did we use strand from inventory or did we procure new strand?

Based on a review of available drawings we were able to determine that the DSQI/II correctors in J, K, M and N spools are the same design as used in standard spools.

Reviews of old files and logbooks, interviews with people who were involved with the fabrication, and a statement from a paper[2] written in 1991 led us to conclude:

- The DDQ corrector in P spools is the same design as in H spools;
- The DD corrector in L spools is the same design as in the inactive I and IA spools.

[2] Production Measurements on the Quadrupole Correctors for the New Low-Beta System for the Tevatron Collider, Fermilab-Conf-91-130

These design conclusions indicate that the cable used to wind the low-beta correctors is different than that used to wind the standard spool correctors. This was confirmed by the information recorded in a spreadsheet dated 6/22/90, made by Debbie Cobb. This spreadsheet shows that new cable was purchased (from three different suppliers) to make correctors for low-beta spools. It also strongly suggests that no additional correctors were built to go into spares inventory. This spreadsheet is attachment IV.

Repair of low-beta devices

During our investigation the issue was raised as to how much time is required to rebuild a defective low-beta device, for example, to replace a defective cold mass with a "reserve" cold mass. We assembled a small group, including persons with first-hand knowledge of fabricating the low-beta devices a decade ago and determined rough estimates for repair time. Due to the fact that there are three spares for Q1/Q5, we chose to focus only on inner triplets and spools. The numbers reported here are in weeks; assuming a three-person work crew, working eight-hour shifts for six days a week. It should be noted that the three-person crew is thought to be optimal for this work, i.e. adding more people will not decrease the time required.

	Q3, Q4	Q2	J/K	M/N	L/P
Tear down:	2	2	2	2	2
Build up:	13	13	16	20	20
Q2 lead box:	-	4	-	-	-
Total:	15	19	18	22	22

Regarding inner-triplet quadrupoles, the post sub-assemblies (ME-261300, ME-261301 and ME-261329) and the tie bars (MC-261303, MC-261304 and MC-261305) may not be salvageable and are long lead items. These assemblies are not in inventory, and a search for individual parts has not been done. Most other parts for inner triplet quadrupoles are thought to be salvageable or easily fabricated.

Given the time needed to repair a defective quadrupole, should we begin work on cryostating the existing "reserve" cold masses? For the single Q3 cold mass this is possible. However, to cryostat the single existing 132-inch cold mass, we would need to decide whether to make it into a Q2 or a Q4. This problem could be addressed by fabricating a new 132-inch cold mass. This brings up the question of availability of cable and strand. We have deferred a lengthy investigation on this subject, but some details are shown below. It should also be noted that a six power lead box (ME-257440, and a product of the Central Helium Liquefier group) is needed in order to fabricate a complete Q2 magnet. At present we do not have a six power lead box spare, and we have deferred investigating what is required to build one.

Most spool parts are thought to not be salvageable. Due to the large number of sub-assemblies, the degree to which one can readily build a spool piece is dependent upon the number of ready sub-assemblies in inventory. The times recorded in the table above assume that the sub-assemblies are not available when fabrication begins. Post assemblies for J/K spools are thought to be long-lead items (MD-276222). This assembly is not in inventory, but a search for individual parts has not been completed.

Strand, cable and sub-coils

In August, 1999, Linda Alsip compiled a report of NbTi material in storage (report dated 8/17/99). Although the report is not clear on every issue regarding strand, we decided at this time to defer pursuing this topic any further. Attachment V is a copy of this report.

The table below indicates the lengths of cable necessary to wind low-beta devices:

Magnet	Q1	Q2	Q3	Q4	Q5	T6
Inner coil (ft)	197	428	731	428	197	72
Outer coil (ft)	286	634	1099	634	286	130
Inner total (ft)	788	1712	2924	1712	788	288
Outer total (ft)	1144	2536	4396	2536	1144	520
Magnet total (ft)	1932	4248	7320	4248	1932	808

Reels of cable have recently been measured for length in IB3. The results are as follows:

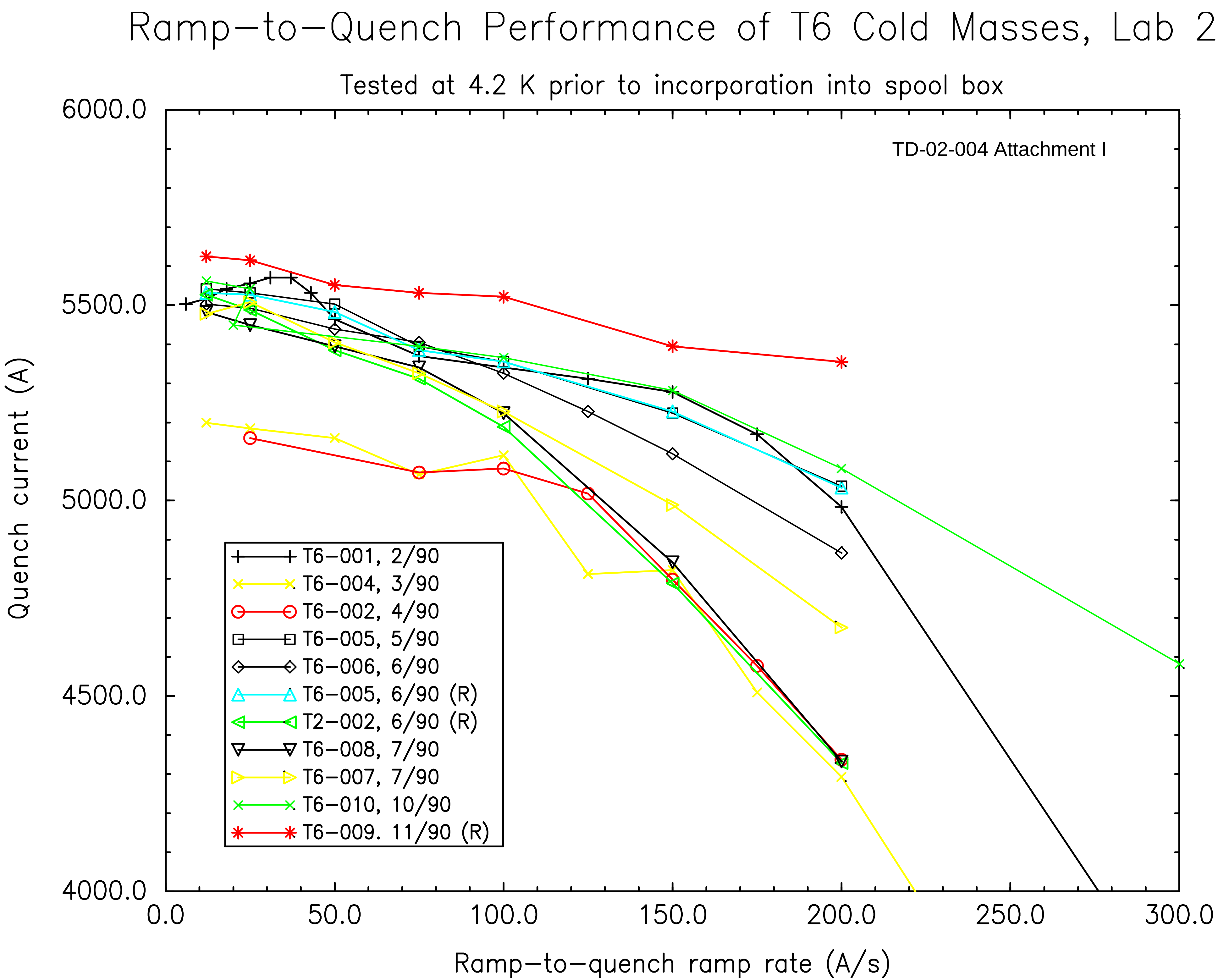
- Reel number 41-462 contains 477 feet of insulated cable;
  - Could be used to wind an inner and outer Q1/Q5, or various T6 coils.
- Reel number 373 contains 1855 feet of insulated cable;
  - Could be used to wind 1 Q3 inner and 1 Q3 outer, with 25 feet remnant.
- Reel number 41-464 contains 3760 feet of bare cable;
  - Could be used to wind 3 Q3 outers, with 463 feet remnant.
- Reel (with no number) contains 2662 feet of cable, of which 499 feet has DMD wrap;
  - Could be used to wind 3 Q3 inners, with 469 feet remnant.
- There is a fifth reel of remnants:

	Number	Length (ft)	Possible uses
(bottom)	41-443	64	None
	41-419	64	None
	41-413A	78	T6 inner
	41-439-1	86	T6 inner
	41-463	83	T6 inner
	388	130	T6 outer or inner
	388-4	98	T6 inner
	41-451	93	T6 inner
	41-439-1	118	T6 inner
	388	97	T6 inner
	41-425B	83	T6 inner
	41-414	117	T6 inner
(top)	unknown	343	T6 outer or inner, Q1/Q5 outer or inner

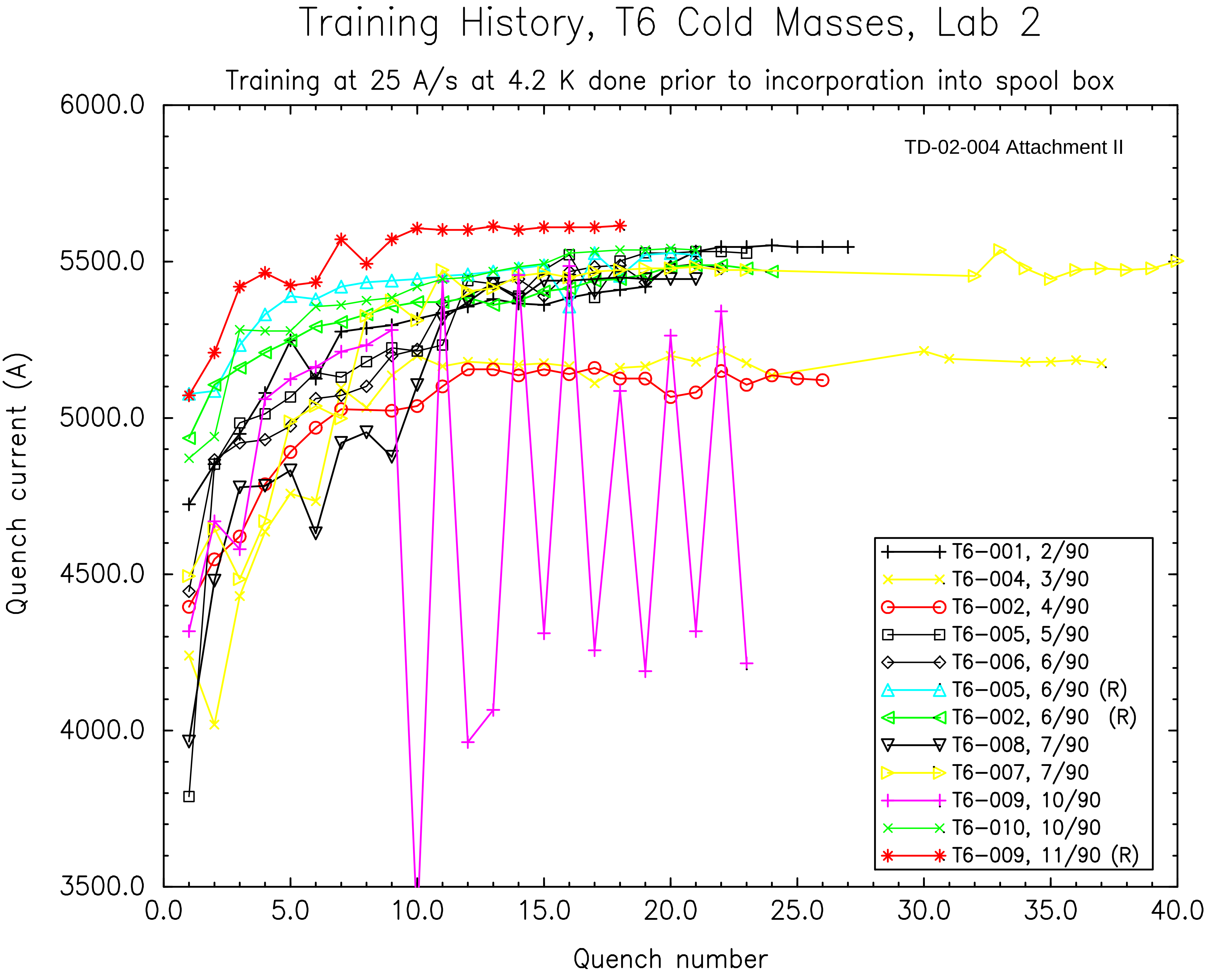
A reel of 5-in-1 cable has also been found in IB3. The anecdotal memory is that this reel was set aside because of some electrical fault.

The statements above regarding the types of sub coils that could be wound from the present cable indicate that four each of inner and outer coils could be wound for a Q3 cold mass. Our experience in fabricating the original low-beta magnets was that we needed to wind six coils in order to wind up with four coils that are sufficiently compatible for making one magnet. This indicates that we do not have enough cable on hand to wind enough coils for a Q3 cold mass. There is enough cable to make at least six each of inner and outer coils for a Q2/Q4 cold mass. However, since winding these coils has not been done for many years, it is not likely that the first attempt to wind coils will be successful. Therefore we should wind the first coils with other cable for practice. The practice cable need not have good quench performance, but should be mechanically identical to production cable. If it desired to procure new cable with the required performance, the Fermilab US-LHC Project Manager told us his understanding of industry status was that 9-12 months are required.

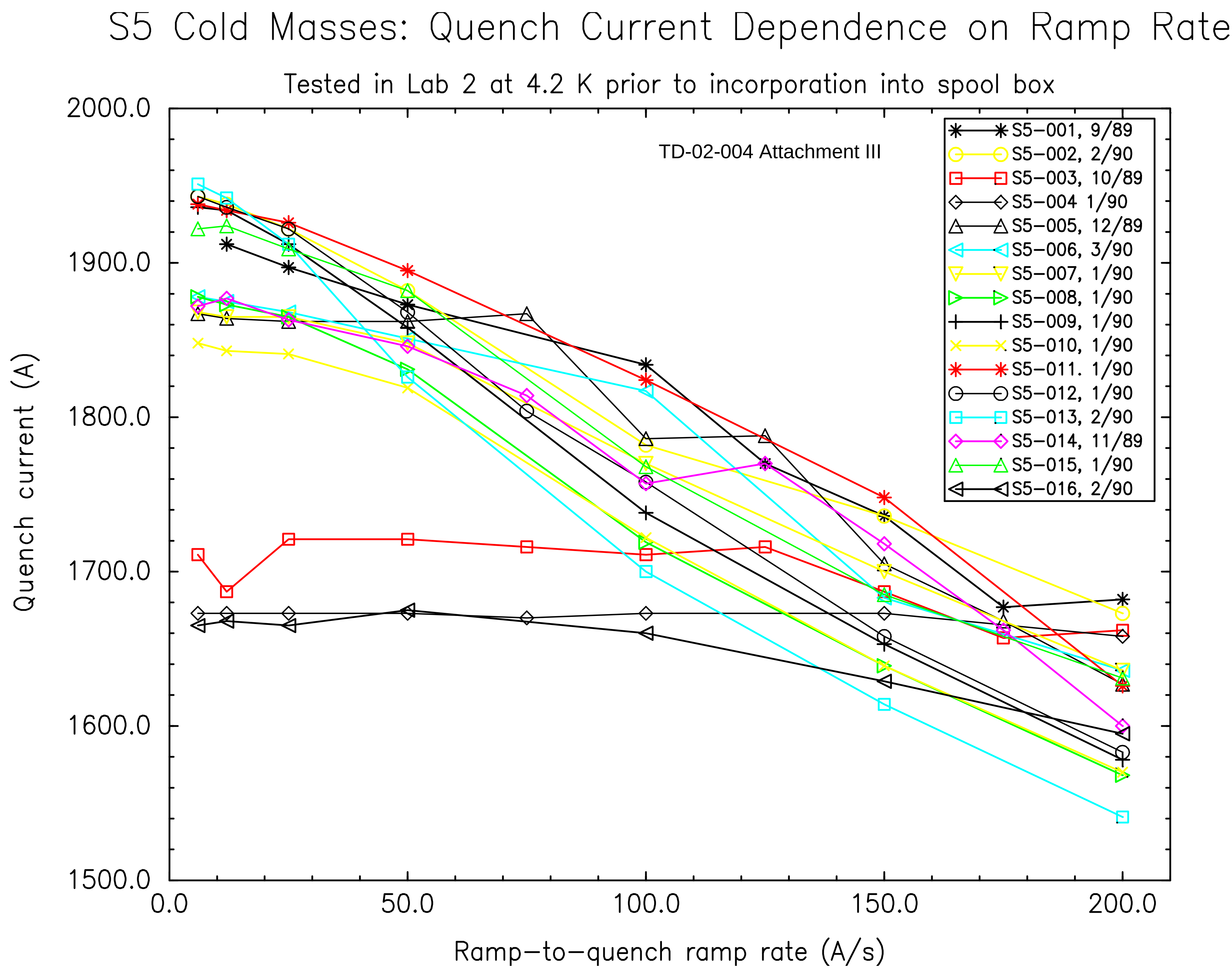
The crate that contains the 5425 "reserve" cold mass also contains numerous T6 and 5-in-1 sub-coils: six T6 inners, seven T6 outers, and seven 5-in-1. It is not known whether or not the inventory of sub coils would yield a set sufficiently compatible for making one magnet because a complete coil set with acceptable magnetic field harmonics requires dimensionally compatible sub coils. Attachment VI is a list of the sub-coils stored in the crate.



Ramp–to–Quench Performance of T6 Cold Masses, Lab 2
Tested at 4.2 K prior to incorporation into spool box
TD-02-004 Attachment I
Quench current (A)
Ramp–to–quench ramp rate (A/s)
6000.0
5500.0
5000.0
4500.0
4000.0
0.0
50.0
100.0
150.0
200.0
250.0
300.0
T6–001, 2/90
T6–004, 3/90
T6–002, 4/90
T6–005, 5/90
T6–006, 6/90
T6–005, 6/90 (R)
T2–002, 6/90 (R)
T6–008, 7/90
T6–007, 7/90
T6–010, 10/90
T6–009. 11/90 (R)



Training History, T6 Cold Masses, Lab 2
Training at 25 A/s at 4.2 K done prior to incorporation into spool box
TD-02-004 Attachment II
Quench current (A)
Quench number
6000.0
5500.0
5000.0
4500.0
4000.0
3500.0
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
T6-001, 2/90
T6-004, 3/90
T6-002, 4/90
T6-005, 5/90
T6-006, 6/90
T6-005, 6/90 (R)
T6-002, 6/90 (R)
T6-008, 7/90
T6-007, 7/90
T6-009, 10/90
T6-010, 10/90
T6-009, 11/90 (R)



S5 Cold Masses: Quench Current Dependence on Ramp Rate
Tested in Lab 2 at 4.2 K prior to incorporation into spool box
TD-02-004 Attachment III
S5-001, 9/89
S5-002, 2/90
S5-003, 10/89
S5-004 1/90
S5-005, 12/89
S5-006, 3/90
S5-007, 1/90
S5-008, 1/90
S5-009, 1/90
S5-010, 1/90
S5-011. 1/90
S5-012, 1/90
S5-013, 2/90
S5-014, 11/89
S5-015, 1/90
S5-016, 2/90
Quench current (A)
Ramp-to-quench ramp rate (A/s)
2000.0
1900.0
1800.0
1700.0
1600.0
1500.0
0.0
50.0
100.0
150.0
200.0

CORRECTION COIL WIRE REASSIGNMENT 6/22/90

P.O.	DATE	W / P	TYPE	AMOUNT	QTY.	COIL #	MAGNET TYPE SERIAL NUMBER	DISPOSITION	REASSIGNMENT AMOUNT	W / P	SPLIT	COMMENTS
949150	5/13/88	WCW	SPS	$35,470.18	250,146 FT							UNIT PRICE PER FT= .14179791
SUPERCON												SIR#S5738-0005
						DSQ2-160 S		SCRAP	TEVATRON WIRE			JOURNAL ENTRY * TRANSFER
						DSQ2-161	TESTING		TEVATRON WIRE			FROM WJA TO WCW 3/90
					18,780 FT	DSQ2-162	TESTING		$2,662.96			TOTAL DOLLAR AMOUNT OF
					18,780 FT	DSQ2-163	TSN001	R&D (1st MAG)	$2,662.96	R&D		P.O. $35,470.18
					18,780 FT	DSQ2-164 S		SCRAP	$2,662.96	R&D		PLEASE NOTE VALUE ON P.O.
					18,780 FT	DSQ2-165 S		SCRAP	$2,662.96	R&D		DOES NOT REFLECT FREIGHT.
					18,780 FT	DSQ2-166 S		SCRAP	$2,662.96	R&D		NEW SIR#S52B4-0002 ON WCW
						DSQ1-177	TSM001		TEVATRON WIRE			
						DSQ1-178	TESTING		TEVATRON WIRE			
						DSQ1-179 S		SCRAP	TEVATRON WIRE			
						DSQ1-180	TESTING		TEVATRON WIRE			
					18,780 FT	DSQ1-181	TESTING		$2,662.96			
					18,780 FT	DSQ1-182	TSM003	AIP	$2,662.96	AIP		
					18,780 FT	DSQ1-183S		SCRAP	$2,662.96	R&D		
					18,780 FT	DSQ1-184	TSM002	AIP	$2,662.96	AIP		
					TOTAL=							
					169,020 FT				$23,966.64			
					DIFFERENCE							
					81,126 FT			WASTAGE	$11,503.50	R&D		
944970	2/22/88	WCW	SPS	$15,769.00	493,337 FT							UNIT PRICE PER FT .071558184
OXFORD		FJJ	AIP	$19,533.30								SIR#S52B4-0001
												JOURNAL ENTRY*TRANSFER
					15,760 FT	DDQ-39	TSP001	AIP	$1,127.75	AIP		FROM WJA TO WCW 4/90
					15,760 FT	DDQ-40S		SCRAP	$1,127.75	R&D		TOTAL DOLLAR AMOUNT OF P.O.
					15,760 FT	DDQ-41	TSP003	AIP	$1,127.75	AIP		$35,302.30
					1,390 FT	*DDQ-42S		SCRAP	$99.46	R&D		
					1,390 FT	*DDQ-43	TSP002	AIP	$99.46	AIP		
					17,,640 FT	DD30-007	TSL001	R&D(1st MAG)	$1,262.29	R&D		PLEASE NOTE VALUE ON P.O.
					18,780 FT	DSQ2-167	TSN003	AIP	$1,343.86	AIP		DOES NOT REFLECT FREIGHT
					5,280 FT	*DSQ2-168	TSN004	AIP	$377.83	AIP		NEW SIR#S52B4-0002
					16,040 FT	*DSQ2-174S		SCRAP	$1,147.79	R&D		INVENTORY TRANSFER OF
					18,780 FT	DSQ2-175S		SCRAP	$1,343.87	R&D		$19,533.30 FROM WJA TO FJJ
					18,780 FT	DSQ2-176S		SCRAP	$1,343.87	R&D		Apr-89
					18,780 FT	DSQ2-177S		SCRAP	$1,343.87	R&D		
					18,780 FT	DSQ2-178	TESTING		$1,343.87			*DENOTES COILS MADE FROM
					14,650 FT	*DSQ2-181	TESTING		$1,048.33			WIRE FROM ANOTHER BILLET
					11,910 FT	*DSQ1-185S		SCRAP	$852.26	R&D		RE:SEE IGC P.O.#957540
					8,300 FT	*DSQ1-194	TESTING		$593.93			
					4,170 FT	*DSQ1-195	TESTING		$298.40			
					5,560 FT	*DSQ1-196	TESTING		$397.86			
					TOTAL=							
					227,510 FT				$16,280.20			
					DIFFERANCE							
					265,827 FT			WASTAGE	$19,022.10	R&D		

D.COBB

CORRECTION COIL WIRE REASSIGNMENT 6/22/90

P.O.	DATE	W / P	TYPE	AMOUNT	QTY.	COIL #	MAGNET TYPE SERIAL NUMBER	DISPOSITION	REASSIGNMENT AMOUNT	W / P	SPLIT	COMMENTS
957540	10/20/88	WCZ	SPS	$4,635.32	525,943 FT							UNIT PRICE PER FT .042309756
IGC		FJJ	AIP	$17,617.20								SIR#SWIPM-0011
												DOLLAR AMOUNT ON P.O. IS
					14,370 FT	DDQ-42S		SCRAP	$607.99	R&D		$23,489.60 (BILLET DID NOT
					14,370 FT	DDQ-43	TSP002	AIP	$607.99	AIP		YIELD FT. STATED ON P.O.
					15,760 FT	DDQ-44	TSP004	AIP	$666.80	AIP		
					15,760 FT	DDQ-45	TSP005	AIP	$666.80	AIP		
					17,640 FT	DD30-008	TSL002	AIP	$746.35	AIP		
					17,640 FT	DD30-009	TSL003	AIP	$746.35	AIP		
						DD30-010	TSL004		TEVATRON WIRE			
					17,640 FT	DD30-011	TSL005	AIP	$746.35	AIP		
					13,500 FT	DSQ2-168	TSN004	AIP	$571.18	AIP		
					18,780 FT	DSQ2-169	TSN005	AIP	$794.58	AIP		
					18,780 FT	DSQ2-170	TSN006	AIP	$794.58	AIP		
					18,780 FT	DSQ2-171S		SCRAP	$794.58	R&D		
					18,780 FT	DSQ2-172S		SCRAP	$794.58	R&D		
					18,780 FT	DSQ2-173S		SCRAP	$794.58	R&D		
						DSQ2-179	TESTING		MYSTERY WIRE			
						DSQ2-180	TESTING		MYSTERY WIRE			
					4,130 FT	DSQ2-181	TSK002	AIP	$174.00	AIP		
					6,870 FT	DSQ1-185S		SCRAP	$290.67	R&D		
					18,780 FT	DSQ1-186	TSM004	AIP	$794.58	AIP		
					18,780 FT	DSQ1-187	TSM005	AIP	$794.58	AIP		
					18,780 FT	DSQ1-188S		SCRAP	$794.58	R&D		
					18,780 FT	DSQ1-189	TSJ001	R&D(1st MAG)	$794.58	R&D		
					18,780 FT	DSQ1-190S		SCRAP	$794.58	R&D		
					18,780 FT	DSQ1-191S		SCRAP	$794.58	R&D		
					18,780 FT	DSQ1-192S		SCRAP	$794.58	R&D		
						DSQ1-193	TSM006		MYSTERY WIRE			
						DSQ1-194	TSM007		MYSTERY WIRE			
						DSQ1-195	TESTING		LBQ STRAND			
						DSQ1-196	TSJ002		LBQ STRAND			
					TOTAL=							
					363,040 FT				$15,360.13			
					DIFFERANCE							
					162,903 FT			WASTAGE	$6,892.39			

E-Mail Larry Vonasch 12/1

Notes on NbTi Material in storage, based on inventory compiled by Linda Alsip.
A. McInturff, G. Sabbi 8/17/99.

Items 1 to 44 and 47 to 59: 6129#

NbTi rods at .126" or .278". According to inventory total WT is about 6 klb. This should be Tevatron material.
We are not interested in processing this material, but we could try to sell it back to Teledyne. Teledyne sells NbTi at about 50$/lb. Even if we get a fraction of that, it could still be a significant amount of money. EXCESS

Item 45:

Coils, Ternary, 1.5:1, diam. .919", WT 765 lb. Stored 2/16/90, storage #12502, PO 934480. This should be LBQ material.
This material was drawn and heat treated at Teledyne up to 0.920" (first three steps of HT schedule), then sent to IGC for the remaining 2 steps (double check with Mac that HT #3, 40h at 420C, was already done). This material could be drawn down to ~.5 mm and used for the hybrid common coil magnet. The LBQ spec for both binary and ternary was 3000 A/mm2 at 4.2 K, 5T and 1350 A/mm2 at 4.2K, 8T. However ternary was about 10% lower than that. Besides, we may want to draw to sligthly bigger diam than 0.5, in this case we may get another 5-10% less Jc as the process was optimized for 0.5 mm. Regarding length, this material comes from a 12" billet which weights ~1000 lb and produces ~600000 ft. so we sould be able to get ~500000 ft of wire at 0.5 mm.

returned to Storage 3/17/00

Item 60:

Coils. Cu/Nb/Nb47%Ti, diam 0.799, WT 212 lb. Stored 11/89. From Teledyne, Fermi PO 975040, attn. L. Vonasch, spec 1620-ES-125781. This should be LBQ material.
Teledyne was doing the first 3 steps of the HT schedule, last was at 0.920" diam, but then they draw further down to 0.8" i.e. max size for IGC draw bench. So this may well be multifilament but it could be monofilament as well, we have to cut a section and inspect to find out. NOT NEEDED
If it is multifilament we could complete the processing and get about 100-150 kft of wire.

returned to Storage 3/17/00

– SMR 26000

Item (?) 61 (not in present list, please add)

NbTi copper clad rod, 431 lb, stored 7/89.
This should be LBQ monofilament, in principle we could assemple a multifilament and process it as well. We should cut a section and inspect. NOT NEEDED

Returned to Storage 3/17/00

SMR* 26009

Item 46

Noses for extrusion can, stored 3/83. Assy #54592-2C, storage #6027, from Janney Cylinder Co. We could try to sell it to IGC. EXCESS

T6 and 5 in 1 Short Coils

copied from a vault

MMR r2569

@ Site 38

30-Jan-02

T6 Inners	T6 Outers	5in1 Coils
T6-19-042	T6-28-041	5-051
T6-19-041	T6-28-047	5-041
T6-19-046	T6-28-042	5-026
T6-19-045	T6-28-045	5-028
T6-19-039	T6-28-043	5-044
T6-19-044	T6-28-001	5-018
	T6-28-044	5-050

5/15/97

54" Coils and Magnets

54" Coils	Inner/Outer	Status
54-19-105	Inner	Turn to turn short
54-19-087	Inner	
54-19-088	Inner	
54-19-094	Inner	
54-19-107	Inner	Turn to turn short
54-19-112	Inner	New insulation scheme
54-19-101	Inner	
54-28-079	Outer	
54-28-092	Outer	
54-28-033	Outer	
54-28-082	Outer	
54-28-105	Outer	

Mechanical Model Coils	Inner/Outer	Status
54-19-089	Inner	In mechanical model magnet
54-19-085	Inner	In mechanical model magnet
54-19-092	Inner	In mechanical model magnet
54-19-093	Inner	In mechanical model magnet
54-28-075	Outer	In mechanical model magnet
54-28-085	Outer	In mechanical model magnet
54-28-096	Outer	In mechanical model magnet
54-28-098	Outer	In mechanical model magnet
LBQN5425F	Whole Magnet	Collared coil assy.

5/15/97